ON THE VALIDITY OF THE GENUS MARGARITANA.

By Chas. T. Simpson.

In 1817, Schumacher founded the genus *Margaritana*[1] for the *Mya margaritifera* of Linnaeus, the *Unio margaritifera* of subsequent authors, on account of the fact that, whereas the shells of the latter genus had both cardinal and lateral hinge teeth, this species had only the cardinals. Say's *Alasmodonta*, applied in 1818[2] to other Naiads having similar teeth, is synonymous. A number of forms have since been added to the groups, mostly by Dr. Lea, and, as it stands to-day, it includes some 26 or 27 species, all confined to North America, with the exception of the type, which is circumboreal.

The soft parts of the different members of this assemblage do not differ generically from those of *Unio*, and any separation from that genus can only be founded on the character of the teeth which I have mentioned. The Margaritanas do not, taken as a whole, form a natural group, but are, undoubtedly, polyphyletic in their origin, several of them being evidently much more nearly related to certain Unios than they are among themselves; and it is only reasonable to suppose, when the facts are all carefully considered, that most, if not all the species, have sprung from different groups of Unios.[3]

The genus *Unio* may be divided into a large number of sections, which are, I think, unworthy of subgeneric rank, but which consist of species that are shown to be closely related by characters of the animal and shell, by habits and the facts of their distribution. In a majority of these groups, though certain species may be considered fairly typical, a close relationship is shown to other groups by species which seem to stand

[1] Essai d'un Noveau Syst. des Habits, des vers Testaces, p. 137, 1817.

[2] Journ. Phila. Acad. Nat. Sci. I, p. 459, 1818.

[3] The earliest recorded species referred to Margaritana is, I believe, the *M. nebrascensis* Meek (Rep. of the U. S. Geol. Surv. of the Territories, Vol. IX, p. 114, 1876), from the Upper Missouri Cretaceous. The genus Unio is now believed to date back into the Triassic.

between and partake of the characters of two or more assemblages; sometimes to that degree that they might, with equal propriety, be placed in either of two or three sections. The same thing is true of the Margaritanas to some extent, and, while a few of the divisions of this so-called genus do not seem to be very closely related to anything else, others show such strong affinities to certain groups of Unios, that they will have to be placed with them in anything like a natural arrangement.

In the Mississippi Valley and on the Atlantic Slope, there is found a small group of Unios fairly typified by *U. pressus*, which consists of compressed, rather quadrate or rhomboidal shells, with strongly undulate beaks, and faintly rayed green epidermis. In the right valve of all these forms, the hinge plate is cut away directly under the beak, and there is a long, curved lateral, and a tolerably perfect, compressed cardinal, the latter separated from the edge of the shell by a deep, parallel sided socket. In the left valve is a somewhat triangular, recurved cardinal, which exactly fits into and fills up this missing area in the hinge plate of the opposite valve; another cardinal fills the parallel sided socket, and there are a couple of usually somewhat blurred laterals. In this group I should place *Unio pressus*, *tappanianus*, *charlottensis*, *neglectus*, and possibly one or two others.

Now *Margaritana rugosa* bears so strong an external resemblance to *Unio pressus*, that one is often taken for the other by persons familiar with the species; the principal difference being that the former is generally somewhat corrugated on the posterior slope, while the latter is without this sculpture, though this distinction does not always hold perfectly good. The arrangement of the teeth is precisely the same in both, but in the *Margaritana* the hinge plate is a little heavier, and the laterals are more blurred or imperfect. Dr. Lea carefully examined specimens of the animals of both, and it will be seen that they are very much alike by the descriptions which I give in his own language. Recently, Dr. V. Sterki, a careful anatomist of New Philadelphia, Ohio, who has dissected these species, has reached the conclusion that they are very nearly related.

LEA'S DESCRIPTION OF *Unio pressus* AND *Margaritana rugosa.*

Unio pressus Lea.	*Margaritana rugosa* Bar.
Branchial uterus occupies the whole of the outer branchiæ.	*Branchial uterus* occupies the whole of the outer branchiæ; brownish, forming a large, massive lobe which extends below the margin.
Branchiæ large, rounded below, free nearly the whole length of the abdominal sac.	*Branchiæ* very large, rounded below, the inner ones much the larger, free nearly the whole length of the abdominal sack.
Palpi small, subangular, united half way down the posterior edges.	*Palpi* rather small, subtriangular, united nearly one-half way down the posterior edges.
Mantle thin, slightly thickened on the margins.	*Mantle* rather thin, much thicker at the margin, blackish on posterier basal edge.
Branchial opening large, blackish on the edge, and with numerous papillæ.	*Branchial opening* rather large, with small, brown papillæ.
Anal opening rather small, blackish, and without papillæ[4].	*Anal opening* rather large, without papillæ.
Superanal opening rather large, united for some distance below, blackish on the edges.	*Superanal opening* very large, with a dark brown line within, united below.
Color of the mass dirty white.	Color of the mass salmon.
Embryonic shell subtriangular, light brown, has hooks.	Embryonic shell triangular, brown, has hooks.

[4] Agassiz claimed that two distinguishing characters of the genus *Margaritana* were (Archiv. fur Naturgeschichte, 1852, I, p. 41) that certain species had gills free from the mantle at their posterior extremities, and that the anal region was not fringed, while in the typical Unios the branchiæ and mantle were united posteriorly, and that both siphonal openings had papillae. According to this, *Unio pressus* and its allies, though having lateral teeth, would be Margaritanas.

It is probable that when Dr. Lea described these two animals, he never thought of their being closely related, yet, with a few trifling exceptions the description of one would answer for the other. In *Margaritana complanata*, which is a somewhat solider, more rounded species, there is essentially the same arrangement of the teeth, the beak sculpture is exactly like that of the group, and specimens are occasionally found which approach *Unio pressus* in form. *Unio charlottensis*, a member of this section, is shaped much like *Margaritana complanata*, and the characters of the animal of the latter show that it is closely related to the other species of the group.

In the section typified by *Margaritana margaritifera*, we have a set of Naiads all having elongated, usually arcuate shells, with black, rayless epidermis. They have commonly two more or less perfectly developed cardinals in the left valve, and one in the right; the hinge plate is elongated, narrow just behind the cardinals, but becoming heavier near the posterior end, and generally rounded on its inner face. All the species which I place in this group have a rather wide border of the prismatic outer layer of the shell projecting beyond the nacre, and which is plainly visible from the inside, and all occasionally have dark-colored blotches on the nacre. I include in it *Margaritana margaritifera* Linn., having a circumboreal distribution; *M. hildrethiana* Lea, of the central Mississippi region; *Unio monodontus*, found in the same territory as the last; *Unio decumbens* Lea, of Tennessee and Northern Alabama; *Unio hembelii* Con., of Louisiana; *Unio crassus* Retz., of Southern Europe, and *U. laosensis* Lea, of Southeastern Asia. In *Margaritana hildrethiana*, there are seldom any laterals, while *M. margaritifera* often has them more or less perfectly developed. A lot of the latter in the National Museum (Museum No. 60,878) from the State of Washington, have a single, well-developed lateral in each valve, while two specimens in the Lea collection, one from Maine (Mus. No. 86,285) and another from Massachusetts (Mus. No. 86,286) have as perfect cardinals and laterals as any *Unio*. *Unio monodontus* usually has the cardinals more or less blurred, and sometimes in old specimens they are reduced to mere tubercles or are even ob-

solete, while a good series of shells will show every variation from those with no laterals at all, to others in which they are perfect.

The latter species has been placed by some authors in *Unio* and by others in *Margaritana.* In *Unio decumbens* and *hembelii* there is a somewhat better development of laterals, though they are often not quite perfect, while in *U. crassus* and *laosensis* both cardinals and laterals are like those of ordinary Unios. Here then in a group of Naiads, which at least by the shell characters appear to be closely related, we have every variation from species which occasionally have neither cardinals or laterals to those in which they are perfect.

So far as is known the animals of these different species do not greatly differ, and Lea's description of that of *Margaritana margaritifera* would almost exactly answer for that of *Unio monodontus.*

Margaritana confragosa, a species found sparingly throughout a considerable part of the Mississippi drainage basin cannot be referred, I think, to any group of Unios, but it evidently has a much closer relation to the *Asperrimus* and *Plicatus* groups than to any Margaritanas. This relation is shown in the form of the shell, which is like that of the species of both of these groups, and by its sculpture, there being two rows of tubercles radiating from the beaks after the manner of those of *Unio asperrimus,* and the body of the shell being plicate as are all the members of the Plicate group. The hinge of this species seems to have become somewhat degenerated or weakened, as it is of unusually light structure for so heavy a shell, and such teeth as appear are generally somewhat compressed. In some specimens the posterior cardinal of the left valve is recurved and cut into serrations on its edge, and fits into a somewhat open space under the beak of the right valve, something after the manner of the *Pressus* group. It will be found in occasional specimens of the *Asperrimus* group that this posterior cardinal though much heavier, is recurved and serrate on its edge, and that there is a partial corresponding break in the usually wide hinge plate of the right valve. But in a large series of *M. confragosa* almost every variation may be

found from a narrow to a heavy hinge plate, and the same is true among the Unios I have just mentioned.[1]

Margaritana holstonia and *M. georgiana*, the latter being perhaps synonymous with the former, so closely resemble some of the Unios of the group typified by *U. nashvillensis* that Dr. Lea himself sometimes referred specimens of them to some of these species, and their only essential difference is that they are generally destitute of the lateral teeth which are present in the Unios.

Such species as *Margaritana raveneliana, spillmanii* and related forms have no laterals, and only partially developed cardinals. In most of the specimens the hinge line is incurved in the region of the rudimentary cardinal teeth, exactly as in the so-called *Anodonta edentula* and its allies, all of which bear close relationship to them, and I believe that they should all be placed in the genus *Unio*, since their animals, so far as is known, agree well with those of that genus.

[1] Lea's description of the soft parts of *Margaritana confragosa* agrees very closely with that of *Unio lachrymosus*, which is synonymous with *U. asperrimus*.

Unio lachrymosus Lea.	*Margaritana confragosa* Say.
Branchiæ very large, inner ones very much the larger, rather thick, very much rounded below, free nearly the whole length of the abdominal sack.	*Branchiæ* very large, nearly semicircular, inner ones much the larger, free the whole length of the abdominal sack.
Palpi very large, transverse, rather thin, subelliptical, united half way down the posterior edges.	*Palpi* very large, pendant, sublunate, united half way down the posterior edges.
Mantle rather thin, with a broad thickened margin.	*Mantle* rather thin, with a thickened broad margin.
Branchial opening very large, with numerous rather small, branched papillæ.	*Branchial opening* rather large, with numerous small, brown papillæ.
Anal opening rather small, without papillæ.	*Anal opening* very small, with very minute papillæ.
Super-anal opening very large, slightly colored on the edges, united for a small distance below, color of the mass whitish.	*Super-anal opening* large and united below, with a dark line on the inner edges. Color of the mass whitish.

The above are Lea's descriptions of the two species.

It would be very interesting indeed to know the exact cause of the obliteration of the teeth of these so-called Margaritanas. The teeth of the Naiads seem to be peculiarly susceptible to injurious influences, and many cases among them somewhat similar to that of the Margaritanas might be cited. In *Cristaria*, a Chinese and Japanese group, the cardinals are generally though not always obsolete, while the laterals in young or merely adult shells are developed. Old specimens are frequently without teeth, like the Anodontas, in which case they are probably absorbed in the process of growth. There is a group of peculiar Naiads found in the East Indian Archipelago, typified by *Unio bengalensis* Lea, of thin structure and lurid purplish or reddish color throughout, having a wide, internal prismatic border visible. In all of them the teeth when present are greatly compressed, and they occur in various stages from a perfect condition to almost complete obliteration, so that the species have been divided up between *Unio* and *Anodonta*. The fact that certain specimens of a given species in the group may have well developed teeth, while in others they may be almost completely wanting leads me to place all the species, which seem to form a very natural group, in *Unio*.

Pseudodon is another genus in which it is quite probable the teeth have degenerated from some cause until in most cases only a single, rounded tubercle, answering to a cardinal, remains in each valve, and one of the Chinese Naiads *Unio biasianus* is a perfect *Margaritana* with blurred laterals like *M. rugosa*, though the species probably groups with the well known *Unio sinensis*. And it is likely that *Bourguignat's* genus *Cameronia*, in which the shell is only toothed behind the beaks, is a depauperate state of *Pleiodon*, a genus in which the teeth are found throughout the entire length of the hinge plate. It is a fact that those species of Unios which seem most closely related to the Margaritanas usually have more or less imperfect laterals, and sometimes feeble or blurred cardinals.

In many localities a large proportion of the specimens of one or more species of *Unio*, especially adult or old shells, while apparently healthy in every other way show diseased hinges in which the epidermis is folded in and greatly pro-

duced, and the teeth and plate are badly injured. And the erosion of the beaks so common to Naiads in many streams usually damages the teeth.

There seem to be two forms of hinges among the so-called Margaritanas, the one like that of *M. margaritifera* and *holstonia*, in which the area occupied in the Unios by the laterals is smooth and destitute of teeth, the other like that of *M. complanata* and *calceola* in which the laterals are badly blurred and broken up as if by disease; the plate being covered with long, low, irregular ridges which run somewhat diagonally across it from the region of the beaks towards the interior of the shell. I would suggest that different causes may have operated to produce these different conditions. Dr. Dall holds, and I believe with good reason, that the teeth of bivalve shells are developed for the purpose of keeping the valves in their proper place. In such cases as they interlock it is well-nigh impossible that one valve should be twisted out of place without injuring the animal or its shell. Nearly all Unios which have strong, perfectly developed teeth live in running water, often in rapid currents, in fact it is well known that the Unios are more generally inhabitants of streams and rivers while the Anodontas, which have no teeth, live as a rule in ponds or other still waters. The different species of *Cristaria*, in which the teeth are reduced to mere rudiments, live in ponds and the ditches of rice fields, in the mud. *Unio hembelii*, with very faint laterals is found in the sluggish bayous of Louisiana. *Margaritana monodonta*, which is often nearly destitute of teeth, though living in rivers is almost invariably found under stones in mud, as is *M. hildrethiana;* both of them therefore being protected from currents. I think that the want of teeth in such forms can be explained by supposing that they have degenerated on account of their being no longer needed.

Such species as *Margaritana confragosa, rugosa, complanata* and the like, which have blurred or distorted teeth usually are found in running water, often in rapid streams, and I am inclined to believe that they are forms which are peculiarly susceptible to injurious influences, and that their teeth have become diseased on account of these influences. And it seems

to me not improbable in certain cases, where water and other elements of environment appear to be favorable for producing normal conditions of the hinge, that the fact of this part of the shell being nearly always blurred and distorted goes to show that the diseased condition has become more or less fixed and is inherited.

Be this as it may the evidence of the shells and soft parts seems to show clearly that *Margaritana* is not a valid genus, but that the name merely stands for certain groups or parts of groups of Unios of polyphyletic origin, and that all the species will have to be relegated to the genus *Unio*.